

R&D in India : Towards the 2% goal



Confederation of Indian Industry

CTIER CENTRE FOR
TECHNOLOGY, INNOVATION
AND ECONOMIC RESEARCH

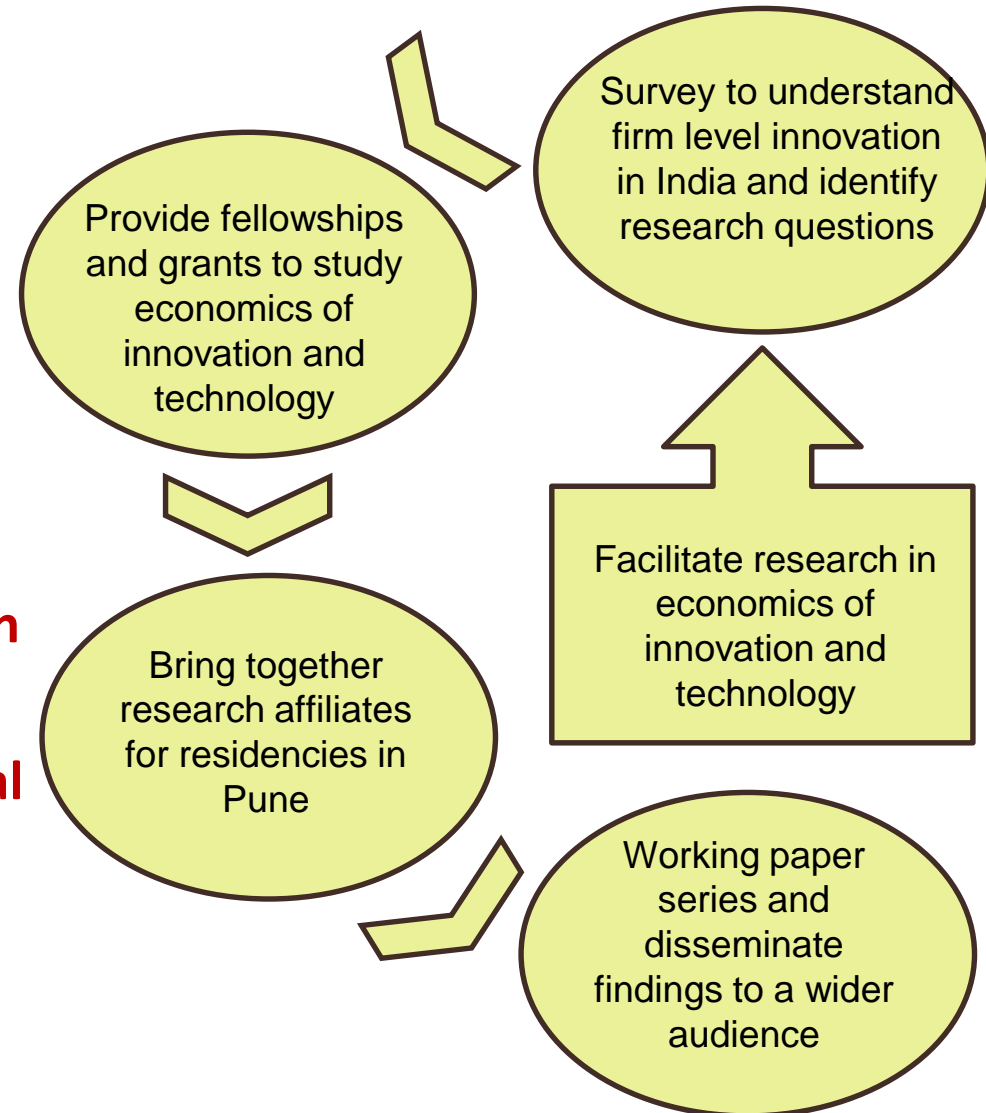
VISION & MISSION

CTIER

The Centre aims to facilitate high quality economic research, provide a platform to influence policy making, and impact higher education in India

A special emphasis shall be on the Economics of Innovation and Technology

The Centre will continuously strive to improve the quality of economic research output in India through training, mutual engagement and debate, and interactions with various stake holders – educational institutions, researchers, practitioners, industry and the government.



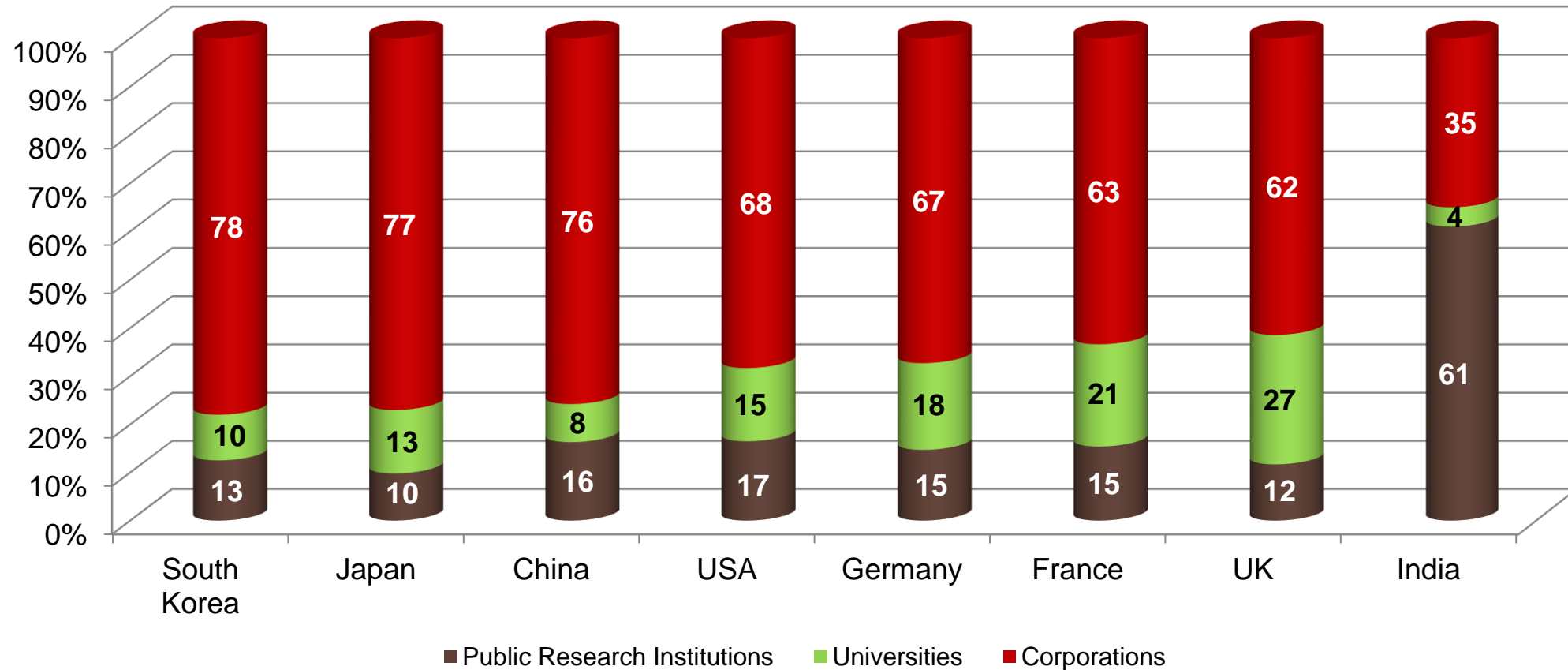
Outline



- **Section I: A Snapshot of R&D in India**
- **Section II: What is the nature of R&D in India?**
- **Section III: Industry – University Collaborations**
- **Section IV: Benchmarking Competitiveness**
- **Section V: Importance of IPR?**
- **Section VI: Influence of Macro policies and schemes**
- **Appendix (includes Short forms used in presentation)**

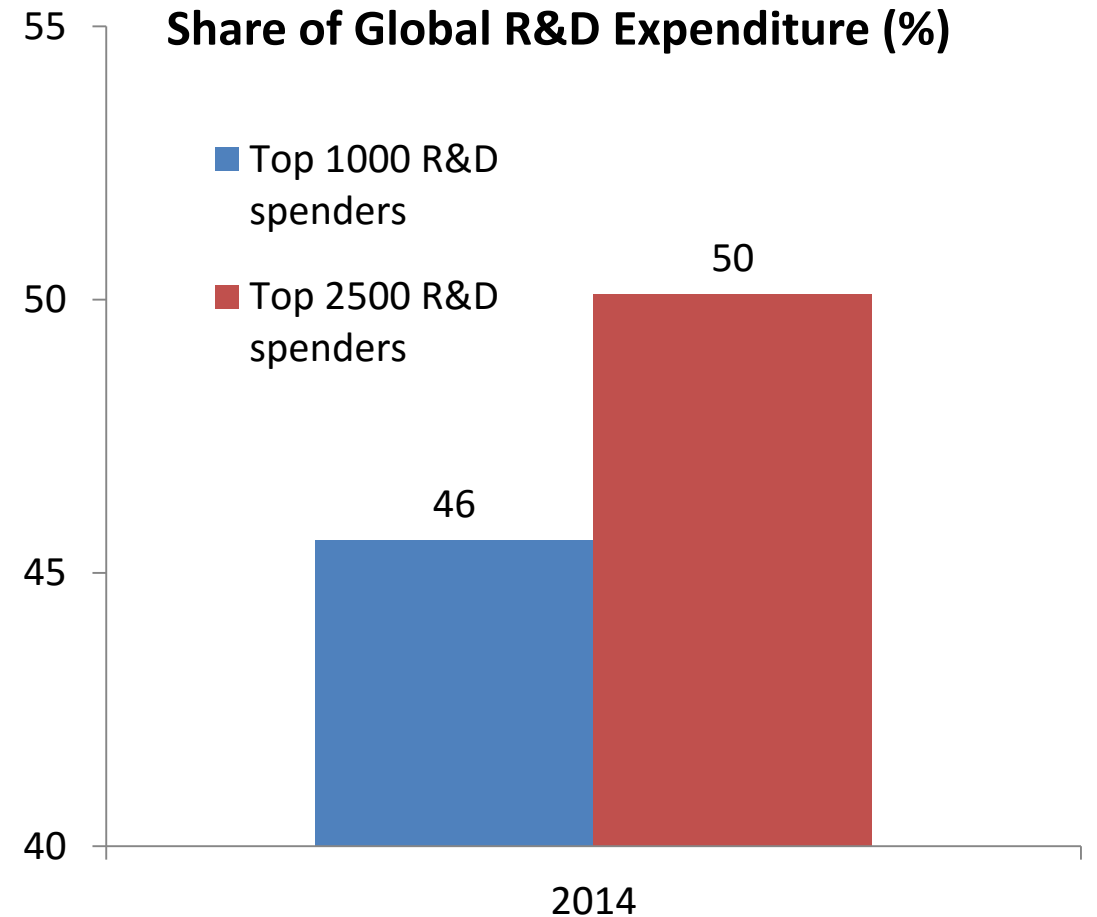
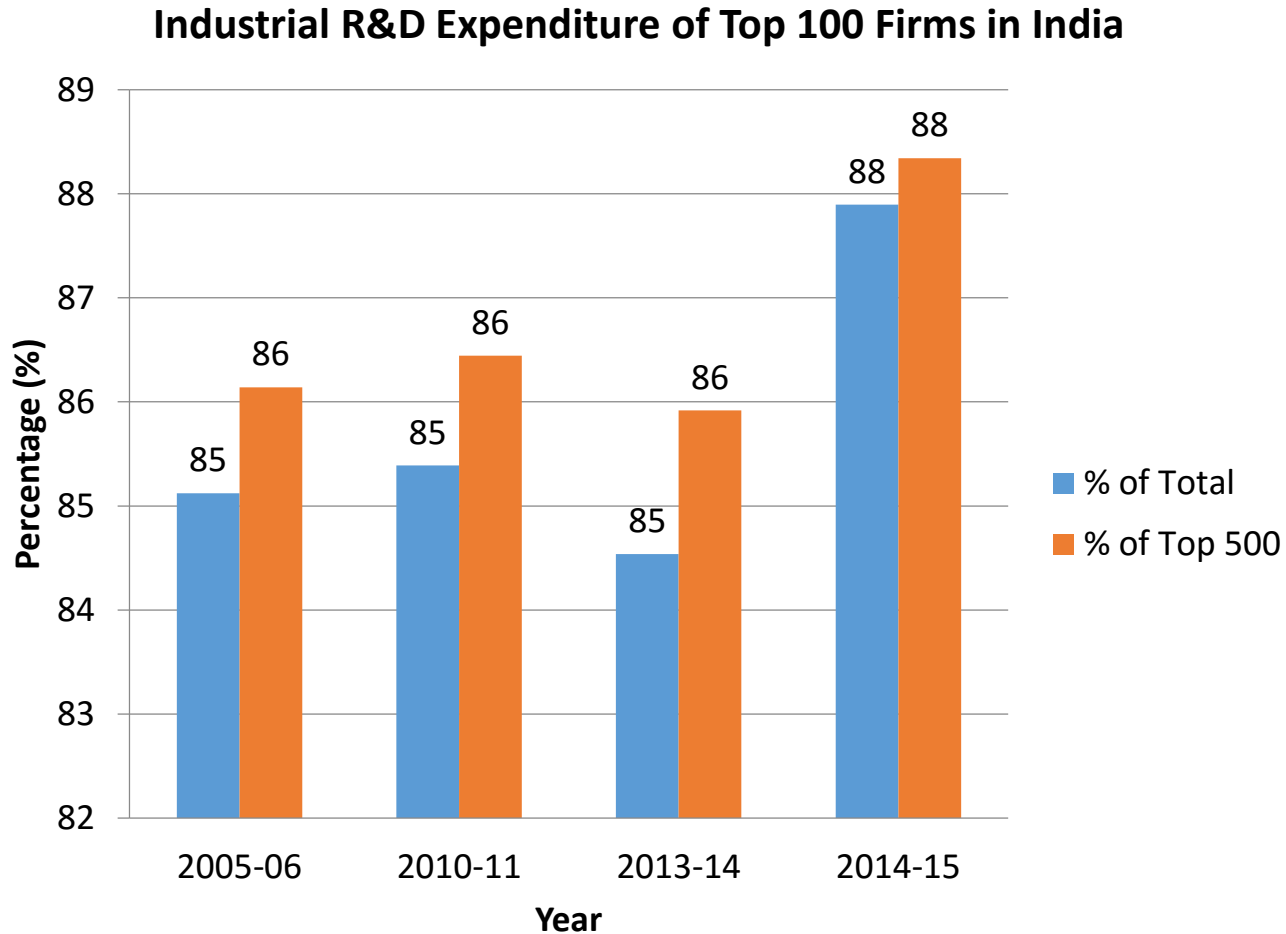
Section I: A Snapshot of R&D in India

India is a complete outlier in the proportion of R&D Expenditure (2011)



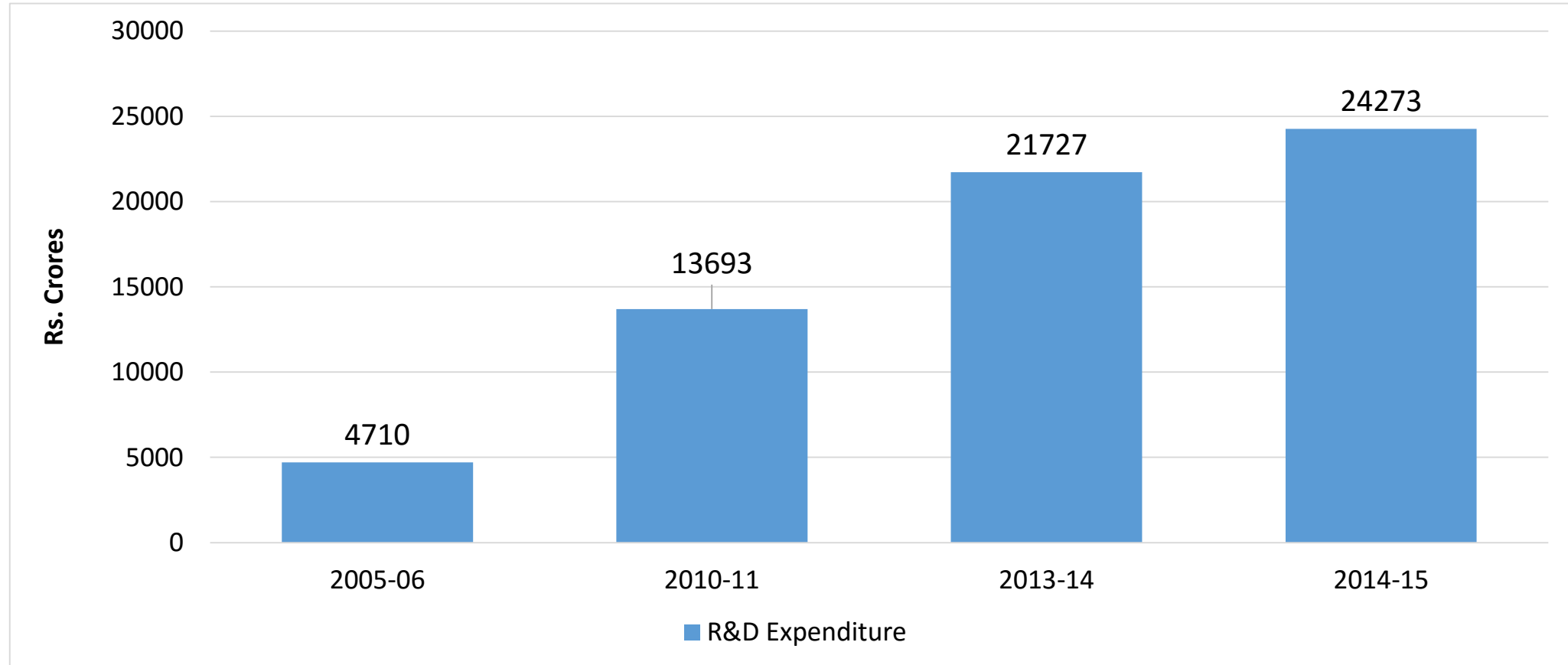
Source: Korea Industrial Technology Association, Korea Ministry of Science, ICT and Future Planning and DST, India

Global Industrial R&D is heavily concentrated in a few firms



Source: Prowess, EU R&D Scoreboard 2015

Total Industrial R&D Expenditure in India



Note: The 2014-15 is an estimated figure

Source : Prowess, CTIER

R&D Expenditure across countries (till 2011)

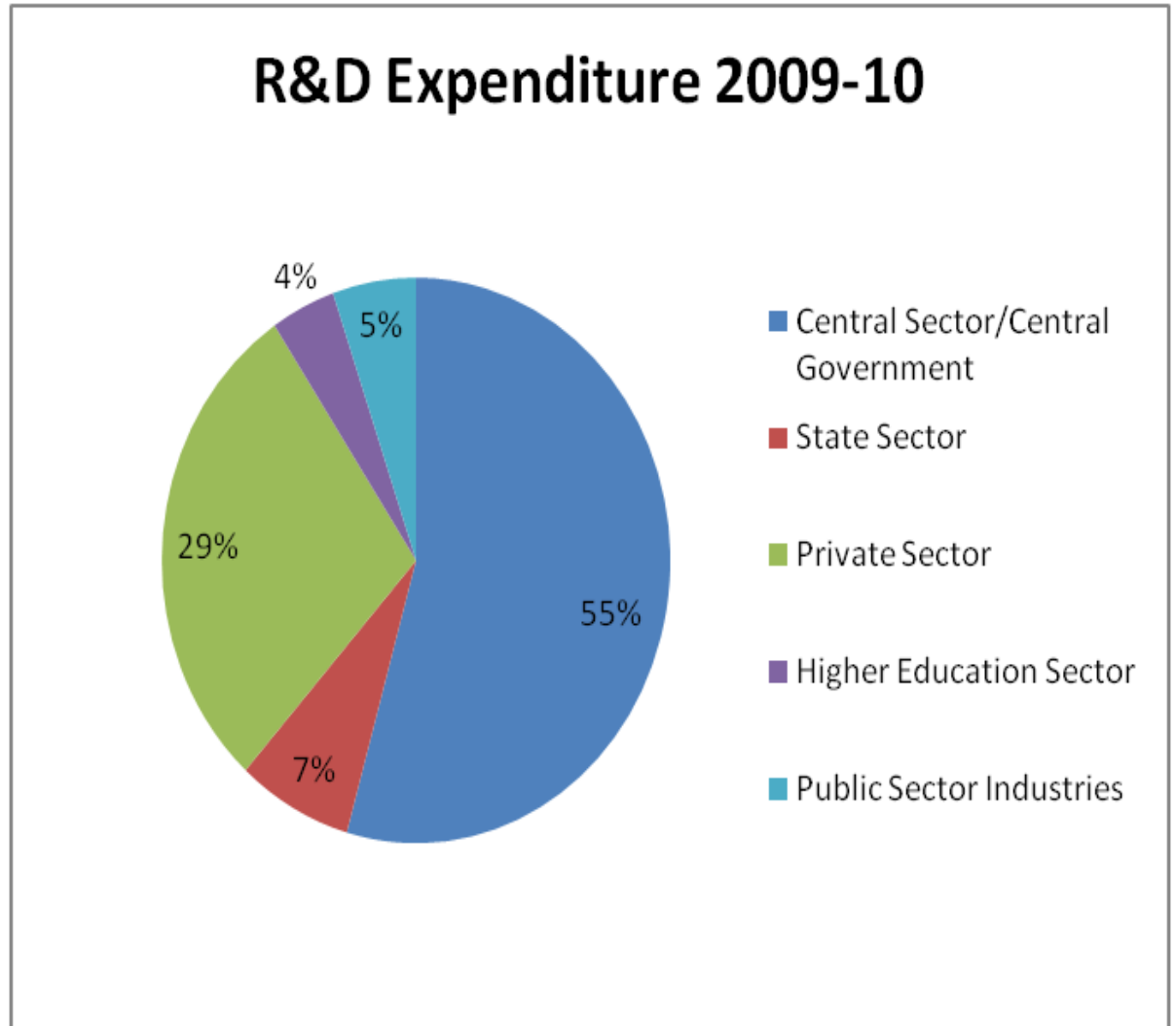


Country	R&D % GDP in 1996	R&D % GDP in 2004	R&D % GDP in 2011
South Korea	2.42	2.68	4.04
Taiwan	1.80	2.56	3.0
Singapore	1.34	2.13	2.2
China	0.57	1.23	1.84
Brazil	N/A	0.9	1.21
India	0.63	0.74	0.81
Mexico	0.26	0.39	0.43
Thailand	0.12	0.26	0.25*

Source: World Bank, UNESCO, National Estimates, * = 2009, OECD, MoEA Taiwan

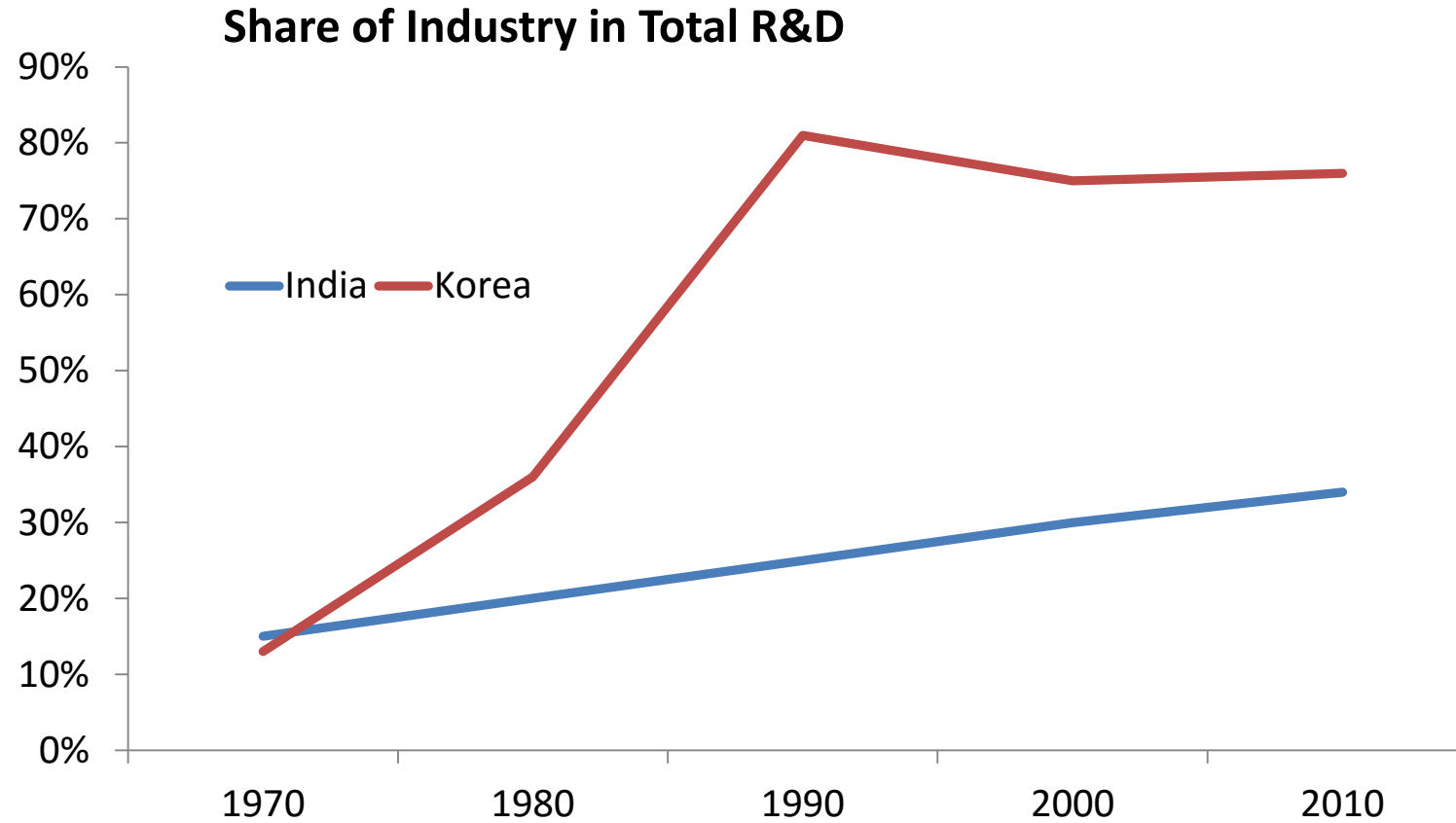
Sector-wise R&D Expenditure (Till 2009-10)

	1990-91 (INR Million)	%	2004-05	%	2009-10	%
Central Sector/Central Government	30,583	77	1,33,542	62	2,88,545	55
Private Sector	5,500	14	56,001	26	1,53,289	29
State Sector	3,659	9	17,231	8	38,720	7
Public Sector Industries					28,112	5
Higher Education Sector			8,616	4	21,747	4
TOTAL	39,742	100	2,15,390	100	5,30,413	100



Source : DST (2010)

Korean industrial R&D expenditure as a share of total R&D expenditure has grown significantly



Source: UNESCO, N Forbes, 2015

Expenditure on R&D by major scientific agencies under the Central Government

CTIER

Agency	Expenditure in 2009-10 in Rupees Million	As % of total central government expenditure	As % of national R&D expenditure
Defence Research & Development Organisation	84754	29	16
Department of Space	41630	14	8
Department of Atomic Energy	38582	13	7
Indian Council of Agricultural Research	28813	10	5
Council of Scientific and Industrial Research	26664	9	5
Department of Science & Technology	22229	8	4
Department of Biotechnology	7274	3	1
Indian Council of Medical Research	5835	2	1
Ministry of Earth Sciences	4482	2	1
Ministry of Environment & Forests	4156	1	1
Ministry of Communication & IT (DIT)	3280	1	1
Ministry of New & Renewable Energy	265	0.1	0
TOTAL	267964	92.9	50.5

Source: DST

US Federal R&D Expenditure - Priority Differences with India



Federal Research and Development Expenditure (includes R&D through Universities)		
(Mandatory and Discretionary budget authority, dollar amounts in millions)		
	2015 Actual	As a % of national R&D expenditure
By Agency		
Defense	65547	13.9
Health and Human Services	30453	6.5
Energy	14354	3.1
NASA	12145	2.6
National Science Foundation	5944	1.3
Agriculture	2452	0.5
Commerce	1524	0.3
Veterans Affairs	1178	0.3
Interior	863	0.2
Transportation	885	0.2
Homeland Security	919	0.2
Environmental Protection Agency	523	0.1
Patient-Centered Outcomes Research Trust Fund	396	0.1
U.S. Agency for International Development	250	0.1
Smithsonian Institution	246	0.1
Education	279	0.1
Other	320	0.1
Total	138278	29.4

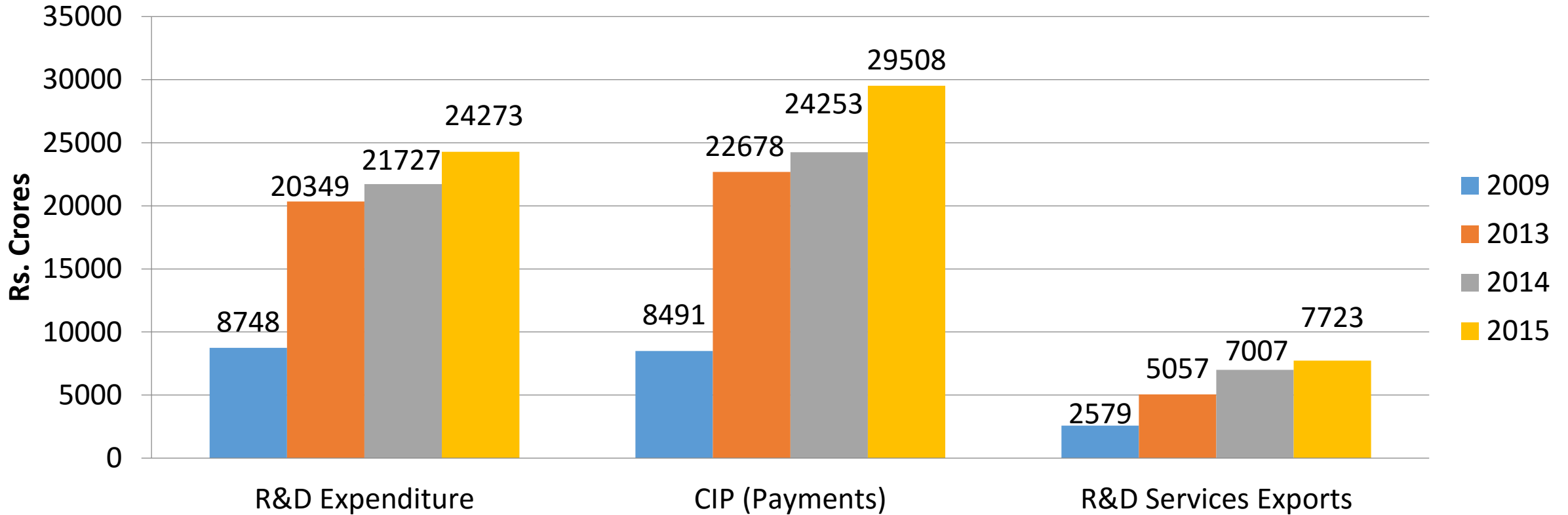
Note: Total US R&D Expenditure ~ USD 470 billion

Source: US Budget Report

Section II: What is the Nature of R&D in India?

- R&D by learning ?
- Technology payments are rising – where are technologies being sourced from?
- Will domestic sources of technology become increasingly important going forward?

Nature of Industrial R&D – Technology imports and R&D contract services rising



- Note:**
- All data are for the respective financial year, unless specified.
 - The 2014-15 R&D Expenditure is an estimated figure
 - The Charges for use of Intellectual Property (CIP)** for 2009 is the amount for the calendar year 2009
 - Charges for Intellectual Property (Receipts in Rs. Crores)**

2009 - 871	2013 - 1647
2014 - 3563	2015 - 3238
 - Other Business Services (Rs. Crores)**

2013 - 155120	2014 - 173559	2015 - 174001
---------------	---------------	---------------

Source: RBI, Prowess

Technology Payments & Receipts **CTIER**

Charges for Use of Intellectual Property			
Country	Receipts (USD Million)	Payments (USD Million)	Surplus/Deficit (USD Million)
US	129178	39016	90,162
Japan	31587	17831	13,756
UK	12947	9037	3,910
Germany	12908	8399	4,509
China	887	21033	-20,146
Russia	738	8389	-7,651
Brazil	597	3669	-3,072
India	446	3904	-3,458

Source: World Bank

Exports of R&D and testing services from India and China to the US, 2006–2011



	R&D and testing services exports (millions of US\$)			Share of global R&D and testing services exports to the US(%)	
	From India to the US	From China to the US	Global exports to the US	India	China
2006	427	92	9276	5	1
2007	923	473	13032	7	4
2008	1494	585	16322	9	4
2009	1356	765	16641	8	5
2010	1625	955	18927	9	5
2011	2109	1287	22360	9	6

Note: This table lists only those R&D services exported from India and China by the affiliates of US multinational companies to their parent company in the US

Source: National Science Board (2014)

Section III: Industry – University collaborations?

- **Research through universities is 4% of Total National R&D Expenditure**
- **Knowledge creation, basic research through Universities?**

Section IV: Benchmarking Competitiveness

- **How do we make our industry more competitive?**
- **What criteria should we use to benchmark competitiveness – Individual firms against Domestic firms? Individual firms against International firms?**

R&D by top 10 Sectors (Derived from top 2500 Global R&D Spenders)



Rank	Sector	R&D expenditure 2014 USD (million)	R&D % of Total (top 2500 spenders)	Total No. of Companies	No. of Indian Companies	No. of Chinese Companies	No. of US Companies
1	Pharmaceuticals & Biotechnology	145401	18%	316	8	21	161
2	Automobiles & Parts	125136	16%	155	6	28	24
3	Technology Hardware & Equipment	124813	16%	316	0	37	130
4	Software & Computer Services	83743	10%	275	5	32	161
5	Electronic & Electrical Equipment	60773	8%	229	0	39	50
6	Industrial Engineering	32300	4%	199	1	30	41
7	Chemicals	27817	4%	133	1	10	38
8	Aerospace & Defence	26829	3%	56	0	6	19
9	General Industrials	23417	3%	96	0	15	24
10	Health Care Equipment & Services	17361	2%	100	0	5	60

Source: EU R&D Scoreboard 2015

Top 10 Sectors performing industrial R&D in India



Rank	Sector	% of Total R&D
1	Pharmaceuticals, medicinal chemical and botanical products	31
2	Motor vehicles, trailers and semi-trailers (Auto)	13
3	Machinery and equipment n.e.c.	8
4	Computer programming, consultancy and related activities	7
5	Other transport equipment	5
6	Chemicals and chemical products	4
7	Electrical equipment (Electrical)	3
8	Basic metals	2
9	Rubber and plastics products	1
10	Other non-metallic mineral products	1

Source : Prowess, CTIER

Comparison of top 10 R&D sectors - India v/s Global



Top 10 Sectors performing industrial R&D in India	% of Total Indian Industrial R&D
Pharmaceuticals, medicinal chemical and botanical products	31%
Motor vehicles, trailers and semi-trailers	13%
Machinery and equipment n.e.c.	8%
Computer programming, consultancy and related activities	7%
Other transport equipment	5%
Chemicals and chemical products	4%
Electrical equipment	3%
Basic metals	2%
Rubber and plastics products	1%
Other non-metallic mineral products	1%

Top 10 Sectors (Derived from top 2500 Global R&D Spenders)	R&D % of Total (top 2500 spenders)
Pharmaceuticals & Biotechnology	18%
Automobiles & Parts	16%
Technology Hardware & Equipment	16%
Software & Computer Services	10%
Electronic & Electrical Equipment	8%
Industrial Engineering	4%
Chemicals	4%
Aerospace & Defence	3%
General Industrials	3%
Health Care Equipment & Services	2%

R&D as % of sales – Comparison with global average



Name	R&D as percent of Sales (R&D Intensity)	R&D Intensity(%) Global Average	Industrial Sector
DR REDDY'S LABORATORIES	12	18	Pharmaceuticals & Biotechnology
LUPIN	8		
SUN PHARMACEUTICAL INDUSTRIES	6		
CIPLA	7		
WOCKHARDT	11		
CADILA HEALTHCARE	6		
PIRAMAL ENTERPRISES	5		
GLENMARK PHARMACEUTICALS	2		
TATA MOTORS	7	5	Automobiles & Parts
MAHINDRA & MAHINDRA	2		
BAJAJ AUTO	2		
ASHOK LEYLAND	2		
APOLLO TYRES	2		
T V S MOTOR COMPANY	2		

Source: EU R&D Scoreboard 2015, Prowess

Name	R&D as percent of Sales (R&D Intensity)	R&D Intensity(%) Global Average	Industrial Sector
INFOSYS	1	18	Software & Computer Services
WIPRO	0.5		
RAMCO SYSTEMS LTD.	37		
TATA CONSULTANCY SERVICES	0.2		
HCL TECHNOLOGIES	0.5		
U P L LTD.	1	5	Chemicals
TATA CHEMICALS LTD.	0.2		
SYNGENTA INDIA LTD.	2		
ASIAN PAINTS LTD.	0.4		
BHARAT HEAVY ELECTRICALS	1	4	Industrial Engineering
LARSEN & TOUBRO LTD.	0.2	2	Construction & Materials
SUZLON ENERGY	1	1	Electricity
TATA STEEL	0.4	1	Industrial Metals & Mining
HINDALCO INDUSTRIES	0.3		
OIL INDIA LTD.	0.3	2	Oil & Gas
RELIANCE INDUSTRIES	0.3		
OIL & NATURAL GAS CORPORATION LTD.	0.3		
HINDUSTAN AERONAUTICS LTD.	7	7	Aerospace and Defence

Section V: Importance of IPR?

- **Is IPR beginning to play an increasingly important role in technology strategy?**
- **Costs involved in managing IPR**
- **Design patents – comparison between China and India**
- **Importance of Design?**

Patents (granted by USPTO) rising... CTIER

Origin	1980	1985	1990	1995	2000	2005	2010	2015
US	40764	43393	52977	64510	97011	82586	121178	155982
KOREA	9	50	290	1240	3472	4590	12508	20201
TAIWAN	72	199	866	2087	5810	5995	9636	12575
CHINA	0	1	43	63	159	565	3301	9004
INDIA	4	11	23	38	131	403	1137	3415
BRAZIL	24	30	45	70	113	98	219	381

Source: USPTO, Sunil Mani, UNESCO

Around 70-80 percent patents granted are to MNCs operating in India

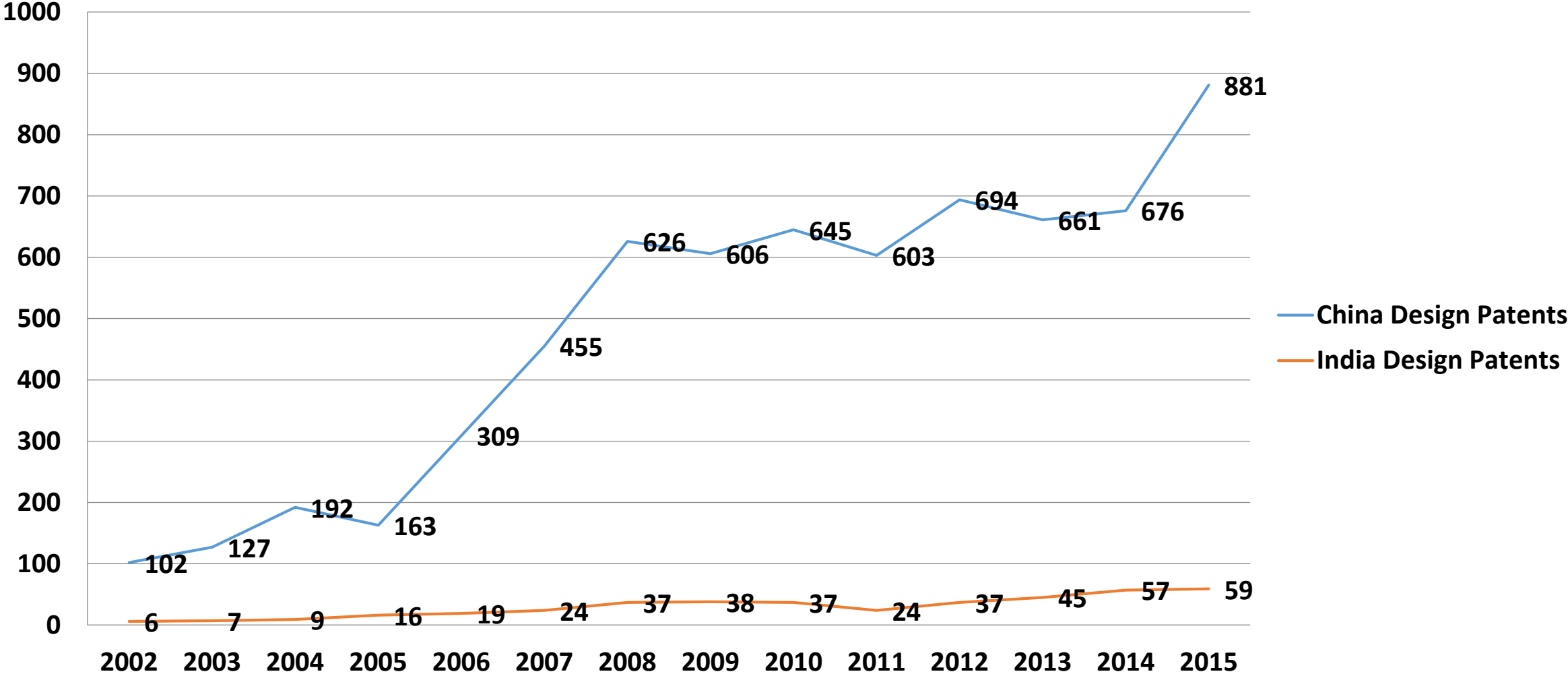
IT-related patents largely owned by MNCs



	IT- related patents (number)			Share (%)	
	Domestic	Multi-national companies	Total	Domestic	Multi-national companies
2008	17	97	114	15	85
2009	21	129	150	14	86
2010	51	245	296	17	83
2011	38	352	390	10	90
2012	54	461	515	10	90
2013	100	1268	1368	7	93

Source: USPTO (2014), Mani

Design Patents – China versus India



Source: USPTO

Section VI: Influence of Macro policies and schemes

- **Awareness and relevance of a number of schemes?**
- **R&D being shaped by regulatory environment?**

Tax Incentives



S.No	Source	Expenditure in respect of policy available	Fiscal Incentive
1	Section 35(2AB) of the Income Tax Act 1961	When expenditure is incurred on scientific research, provided it is not specified in the list of the Eleventh Schedule (not being expenditure in the nature of cost of any land or building) and the in-house research and development facility is approved by the prescribed authority	200% Weighted Deduction
2	Section 35(1)(ii) of the Income Tax Act 1961	Any sum paid to a research association, to a university, college or other institution used for scientific research provided it is approved, in accordance with the guidelines of the prescribed authority - qualifies for deduction for an amount equal to one and three-fourth times of such sum paid.	175% Weighted Deduction
3	Section 35(2AA) of the Income Tax Act 1961	An amount paid to a National Laboratory or a University or an Indian Institute of Technology or a specified person with a specific direction that the said sum shall be used for scientific research - qualifies for a deduction equal to two times the sum so paid.	200% Weighted Deduction
5	Section 80IB (8A) of the Income Tax Act 1961	The amount of deduction in the case of any company carrying on scientific research and development shall be hundred per cent of the profits and gains of such business for a period of ten consecutive assessment years, beginning from the initial assessment year, if such company is approved by the prescribed authority and— (i) is registered in India; (ii) has its main object the scientific and industrial research and development;	10 Year Tax Holiday
6	Section 35(1)(iv) of the Income Tax Act	In respect of any expenditure of a capital nature on scientific research related to the business carried on by the assessee	100% Write-off (Capital)
7	Section 35 (1)(i) of the Income Tax Act	In respect of any expenditure (not being in the nature of capital expenditure) laid out or expended on scientific research related to the business	100% Write off (Revenue)
8	Rule 5(2) of Income Tax rules, 1962	Machinery or plant installed for the purposes of business or manufacturing which uses indigenous technology (technology or know how developed in a laboratory owned or financed by the government) qualifies for depreciation at the rate of 40 per cent of written down value provided the right to use such technology has been acquired from the owner.	Depreciation Allowance
9	Notification No.50/96-customs, dated 23 rd July 1996	Exemption from customs duty on imports made for R&D projects funded by Government	Custom duty exemption
10	Notification No.24/2007-customs, dated 1 st March 2007	If the import comprises of Scientific and technical instruments, apparatus, equipment (including computers); accessories, parts, consumables, it qualifies for an exemption	Custom duty exemption (Capital Equipment)
11	DSIR Annual Report 2014-15	Central Excise duty waiver on items purchased from the domestic market by approved institutions/SIROs for R&D	Central Excise duty waiver
12	Notification No.13/99-customs, dated 1 st March 2007	Central excise duty waiver for 3 years on goods designed and developed by a wholly owned Indian company and patented in any two countries out of: India, USA, Japan and any one country of European Union	Central Excise duty waiver
13	Notification No.26/2003-customs, dated 1 st March 2003	Exemption for goods specified in List-28 (comprising of analytical and specialty equipment) for use in pharmaceutical and biotechnology sector allowed to be imported duty free	Custom Duty Exemptions

Government R&D Schemes



Department/Ministry	Scheme	Scheme Details
Department of Biotechnology (DBT)	Biotechnology Industry Partnership Programme (BIPP)	50% of the project costs
	Contract Research Scheme	Supports 100% of the project costs over 5 installments
	Industry Innovation Programme on Medical Electronics (IIPME)	Mix of loans and grants not exceeding Rs. 100 lakhs for early stages of research and development at Indian companies
Department of Electronics and Information Technology (DeitY)	Support for International Patent Protection in Electronics & Information Technology (SIP-EIT)	Rs. 15 lakhs per invention or 50% of the costs required in filing and processing of patent applications
	Multiplier Grant Scheme	financial support up to twice that provided by industry
	R&D Funding Scheme	Amounts vary depending on the projects
Ministry of New and Renewable Energy (MNRE)	Research, Design and Development of Solar Photovoltaic Technology (SPV) and Solar Thermal Technology (ST) Programme	Up to 50% of the project cost.
Council of Scientific and Industrial Research (CSIR)	CSIR Research Grants	Up to Rs.30,000 per month as a research fellowship.
Department of Science and Technology	Project Finance through the Technology Development Board	Equity participation, loans and in certain cases, grants.
	Global Innovation and Technology Alliance	Soft loans and grants

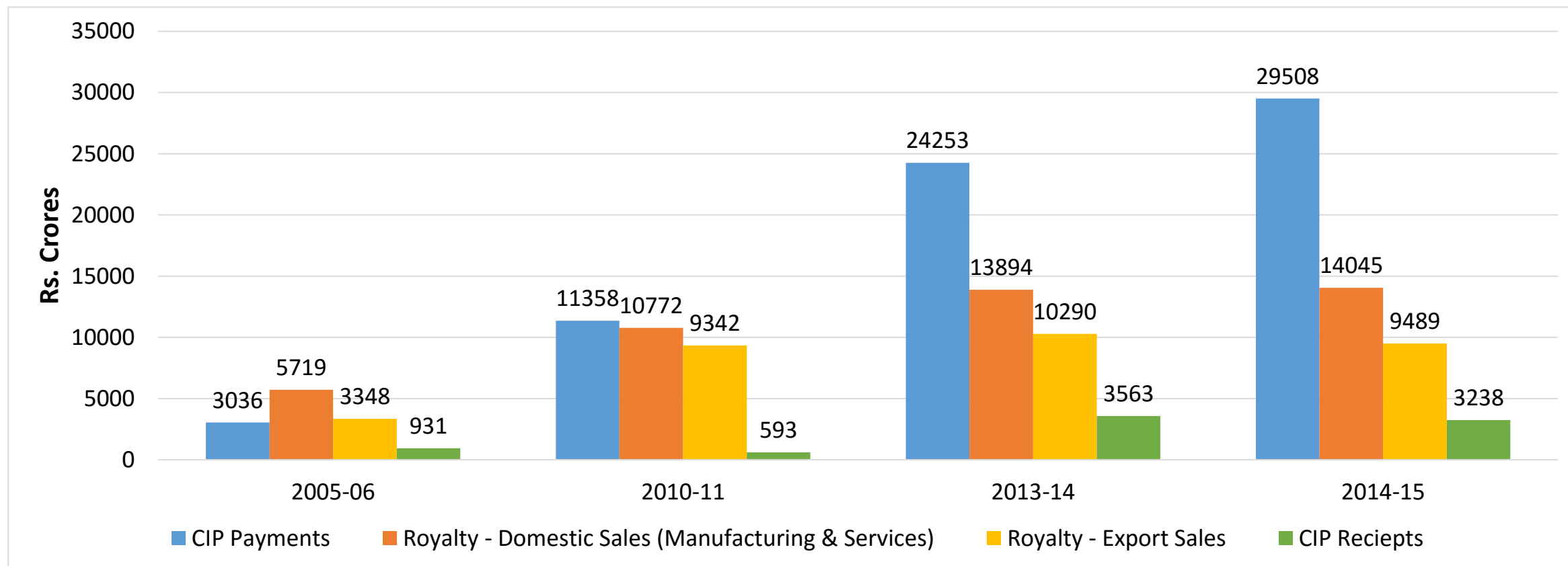
CTIER

APPENDIX

Short forms Used

- **CIP:** Charges for the use of intellectual property (patents, trademarks, copyrights etc.)
- **DST:** Department of Science & Technology
- **EU:** European Union
- **IPR:** Intellectual Property Rights
- **MoEA Taiwan:** Ministry of Economic Affairs Taiwan
- **N.E.C:** Not Elsewhere Classified
- **OECD:** Organisation for Economic Co-operation and Development
- **TFP:** Total Factor Productivity
- **UNESCO:** United Nations Educational, Scientific and Cultural Organisation
- **USPTO:** United States Patent and Trademark Office

India's Technology Payments Led by Royalty Fees



Note: Royalty – Mining and Extraction (Rs. Crores)

2005-06 – 8945

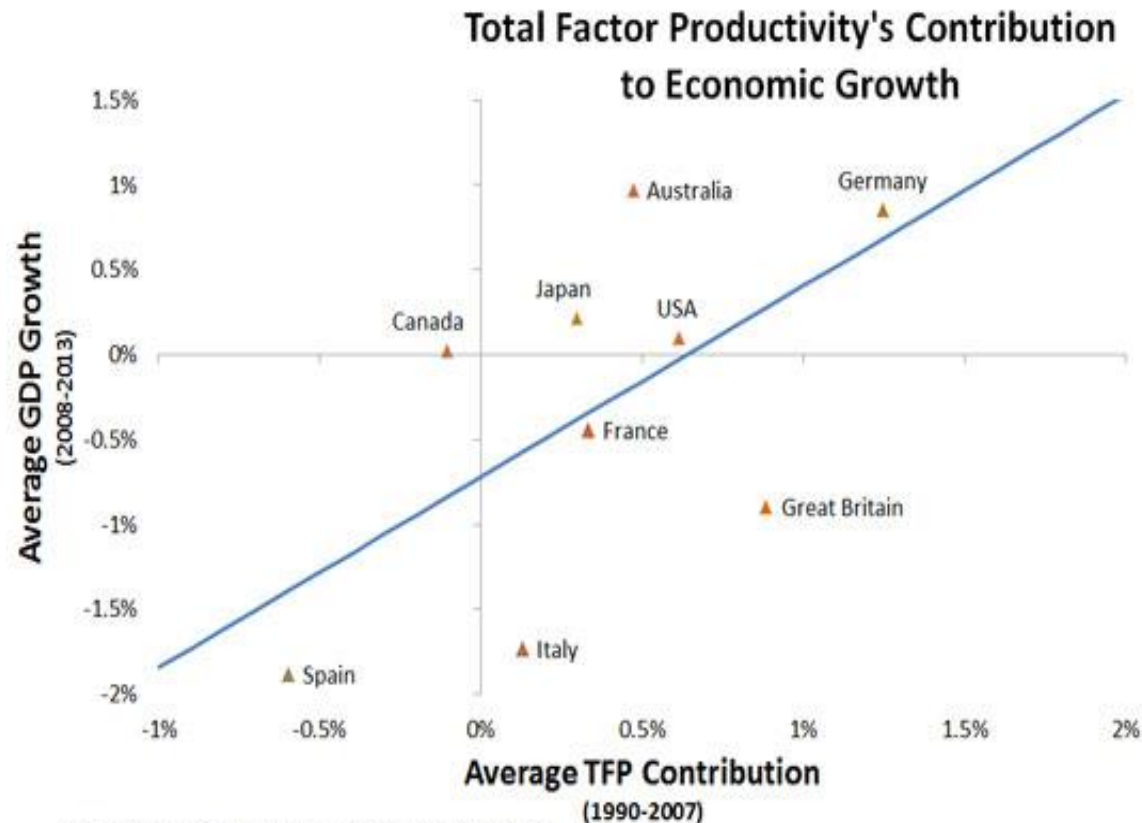
2010-11 – 16057

2013-14 - 23656

2014-15 – 23899

Source : Prowess, CTIER, RBI

Technology and Economic Growth



NOTE: The blue line shows the correlation, which was 0.59.

SOURCE: Conference Board's Total Economy Database and author's calculations.

FEDERAL RESERVE BANK of ST. LOUIS

Source: Federal Reserve Bank of St. Louis